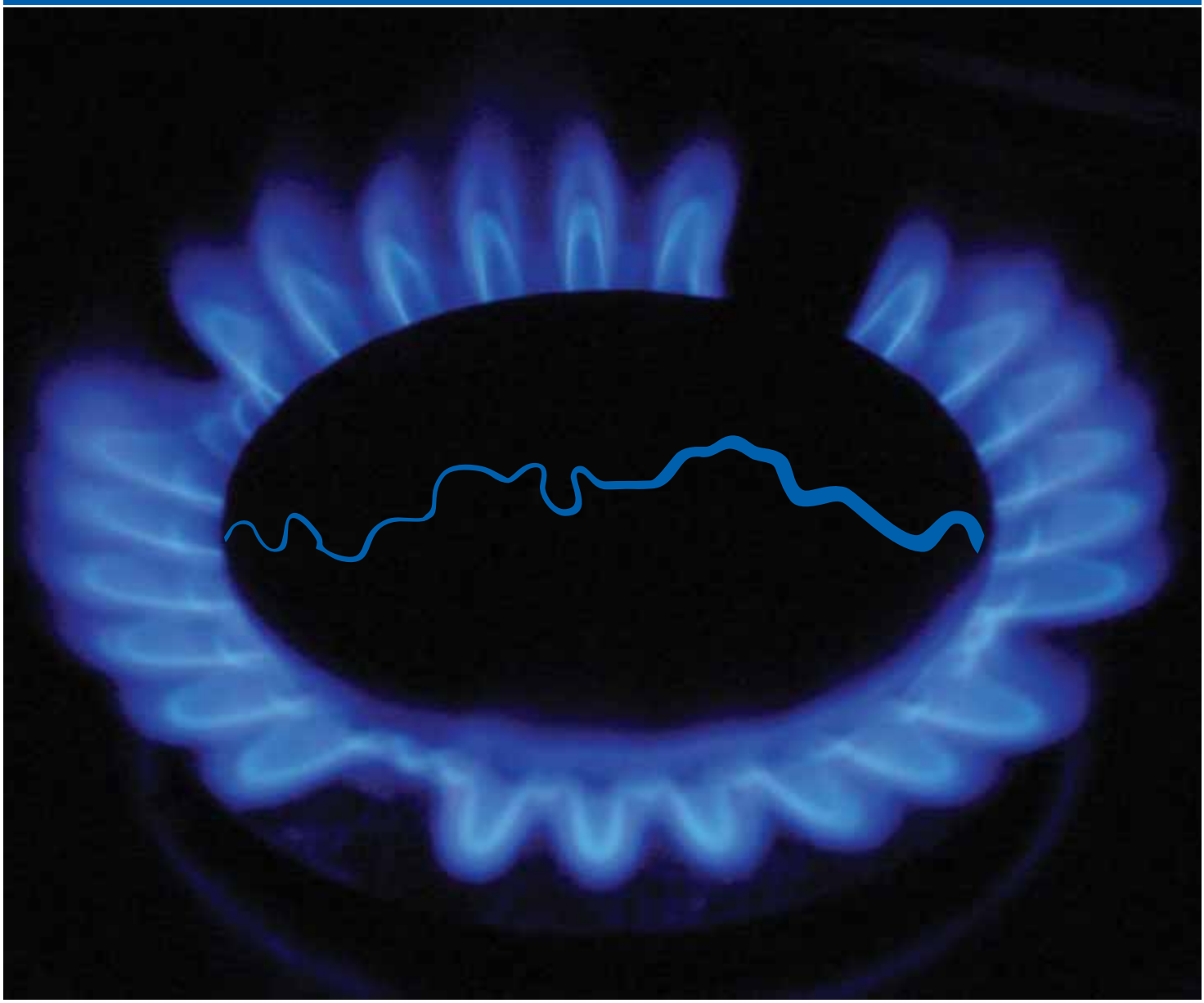
MAYOR OF LONDON

The London Community Heating Development Study-Summary Report

May 2005



MAYOR OF LONDON

The London Community Heating Development Study-Summary Report

May 2005

copyright

Greater London Authority
May 2005

Published by
Greater London Authority
City Hall
The Queen's Walk
More London
London SE1 2AA
www.london.gov.uk
enquiries **020 7983 4100**
minicom **020 7983 4458**

ISBN 1 85261 858 2

Cover photograph
@ Fran Evans

This publication is printed on recycled paper

This report has been produced on behalf of the Mayor of London
by PB Power Energy Services Division, Parnell House, 25 Wilton Road,
London SW1V 1LW
tel: 44-(0)20-7798-2400
fax: 44-(0)20-7798-2401
www.pbworld.com/power

Contents

Abbreviations

CCGT	Combined Cycle Gas Turbine
CCL	Climate Change Levy
CEP	Community Energy Programme
CHP	Combined Heat and Power
CO_2	Carbon Dioxide (a product of combustion)
CH	Community Heating
DHWS	Domestic Hot Water Service
GCV	Gross Calorific Value
LTHW	Low Temperature Hot Water
MVHR	Mechanical ventilation with heat recovery
p.a.	per annum
PBPES	PB Power – Energy Services Division
ROC	Renewable Obligation Certificates

Units

°C	Degrees Celsius
bar	Pressure, bar
hr	Hour
kW	Power, kilowatts (10^3 watts)
kWh	Energy, kilowatt hour
MW	Power, megawatts (10^6 watts)
MWe	Electrical Power, mega watt (10^6 watts)
MWth	Thermal Power – hot water, mega watt (10^6 watts)
GWh	Gigawatt hour (1,000,000 kWh)
tC	tonnes of Carbon
tCO_2	tonnes of Carbon Dioxide

Executive Summary

The Greater London Authority (GLA), with the support of the London Development Agency (LDA) and the London Boroughs of Tower Hamlets, Lewisham, Southwark and Lambeth, appointed Parsons Brinckerhoff Ltd in association with RAMBOLL to carry out a detailed study of the potential for Community Heating (CH) in London. The study has been supported with a development grant from the Community Energy Programme (CEP).

The first stage of the work was to review the potential for Community Heating across London and the technologies that could be used to supply low carbon heat. Following this review, Priority Areas were identified and nine Community Heating schemes were defined. From these schemes three were selected for more detailed analysis. These were:

- a scheme based on the existing South East London Combined Heat and Power waste to energy plant, taking heat from this plant to supply 8,777 dwellings in LB Southwark, and 4,175 dwellings in Lewisham including the new build development at Convoys Wharf;
- a scheme based in Brixton and Camberwell supplying 4,285 dwellings, two hospitals and a college. The heat source would be a 10MWe CHP plant using two gas-fired reciprocating engines, located at or near the hospitals;
- a scheme supplying 3,552 dwellings in Tower Hamlets and the London Hospital at Whitechapel. The heat source would be a 20MWe biomass CHP plant able to utilise clean waste wood which is generated in London and currently sent to landfill.

An economic and environmental analysis was carried out for each scheme in accordance with the requirements of the Community Energy Programme (CEP). The key results are given in Table 1 below. The CH/CHP option is compared with the 'Do-minimum' option and the 'alternative' option of new gas-fired boilers or, in the case of the Tower Hamlets scheme, small-scale CHP plant. In all cases the lowest Net Present Cost (NPC) at a 3.5% discount rate was obtained with the CH/CHP scheme. The Net Present Value (NPV) represents the NPV for the investment if the heat was sold at a price equal to that of the operating costs predicted under the do-minimum option.

Following a study of available business structures for the new CH infrastructure, business plans were drawn up for the three prioritised schemes.

The SELCHP scheme would be developed in Phases with Phase 1A being funded by the LB Southwark (LBS), a CEP capital grant and by SELCHP (for the work within the SELCHP plant). It is recommended that an internal management structure be set up within LBS to enable costs to be monitored and notional company accounts to be prepared so that a form of public-private partnership could be set up at a later date with full knowledge of the business opportunity.

The business model selected to prepare the Business plan for the Brixton and Camberwell scheme would be a public-private partnership energy services company, which would be able to raise the necessary capital and operate the scheme.

The Tower Hamlets scheme is assumed to be developed under the Limited Liability Partnership arrangement whereby interested parties agree to participate in a number of ways and share the net income from the project in defined shares. This arrangement is very flexible and provides an incentive to all parties to maximise the net income from the project, rather than just their own area of interest, to make the scheme a success.

Table 1 – Summary of economic and environmental results of Options Appraisals

SELCHP Phase 1A					
Option	**Capital**	**NPC before heat sales**	**NPV**	**CO_2 emissions**	**reduction**
	£	£	£	tonnes p.a.	tonnes
Do-minimum	0	13,802,065		10,513	
Alternative	2,228,759	13,580,164	221,901	9,615	898
CH-CHP	5,353,933	10,218,320	3,583,746	2,797	7,716

SELCHP All Phases					
Option	**Capital**	**NPC before heat sales**	**NPV**	**CO_2 emissions**	**reduction**
	£	£	£	tonnes p.a.	tonnes
Do-minimum	0	71,863,648		49,203	
Alternative	8,738,783	83,729,691	-11,866,043	45,003	4,200
CH-CHP	26,660,542	68,177,837	3,685,811	21,125	28,078

Brixton / Camberwell					
Option	**Capital**	**NPC before heat sales**	**NPV**	**CO_2 emissions**	**reduction**
	£	£	£	tonnes p.a.	tonnes
Do-minimum	0	33,951,587		23,020	
Alternative	4,156,780	32,948,832	1,922,251	21,204	1,816
Gas engine CHP	13,958,910	31,026,581	2,925,006	11,814	11,206

Tower Hamlets					
Option	**Capital**	**NPC before heat sales**	**NPV**	**CO_2 emissions**	**reduction**
	£	£	£	tonnes p.a.	tonnes
Do-minimum	0	49,486,651		32,183	
Alternative	21,879,549	39,745,786	9,740,865	23,642	8,541
Biomass CH-CHP	49,669,020	41,029,629	8,457,022	-55,679	87,862

In addition to the evaluation of the three schemes above a study was made of the possible energy strategies for the Thames Gateway new build areas. A total of 39 strategies were identified and compared to two benchmark levels of using electricity and gas for heating to current Building Regulations. The strategies included Community Heating supplied from local gas-engine CHP as well as the provision of heat from the existing Combined Cycle Gas Turbine (CCGT) power station at Barking.

The reductions in CO_2 emissions from this benchmark level for housing for some of the options is given in Table 2 below. This shows that the supply of heat from the existing power station at Barking is an attractive option and compares well with the local large gas-engine CHP option and the gas-fired condensing boilers with solar thermal panels option.

Table 2 - CO_2 emissions per dwelling for a range of possible energy strategies for new-build (assuming an electricity emissions factor of 430g/kWh)

Scenario	Type of heat source	Carbon Dioxide Emissions	CO2 Emission Reduction to ADL2002(A1)
		$kgCO_2$ /dwg p.a.	%
A1	Electric (2002)	3,010	0.0%
A2	Electric with MVHR	2,390	20.6%
B2	Gas boilers	1,598	46.9%
B6	Micro-CHP	1,457	51.6%
D1	Small gas-engine CHP	1,429	52.5%
E1	Large gas-engine CHP	1,332	55.7%
B4	Gas boilers with solar thermal	1,325	56.0%
F1	CCGT CH-CHP	1,244	58.7%

A preliminary economic analysis showed that the Barking power station CH scheme would be most viable if the buildings in the Royal Docks area were included as well as the areas of South Dagenham, Barking Riverside and Barking town centre. It would be technically feasible to extend the pipeline to the Lower Lea Valley and even supply Tower Hamlets, however the economic and environmental benefits were not as good as the proposed biomass CH/CHP project. Further work is required to establish whether the concept of a large-scale CH network is the most economic energy strategy for the northern part of the Thames Gateway. It would appear to offer the greatest CO_2 saving apart from biomass and could be attractive economically.

The report lists a number of recommendations regarding the taking forward of these proposed Community Heating schemes.

1. Introduction

1.1 The London Community Heating Development Study

The Greater London Authority (GLA), with the support of the London Development Agency (LDA) and the London Boroughs of Tower Hamlets, Lewisham, Southwark and Lambeth, appointed Parsons Brinckerhoff Ltd in association with RAMBOLL to carry out a detailed study of the potential for Community Heating (CH) in London.

The Mayor's Energy Strategy (1) states:

Proposal 53: 'The Mayor will strongly support the development of community heating networks in London, building on the results of the London Community Heating Development Study.'

Policy 12: 'The Mayor supports the expansion of community heating in London as a means of reducing carbon dioxide emissions and helping to deliver affordable warmth.'

Proposal 19: The Mayor will work with London Waste, SELCHP, the waste authorities, boroughs and local industry to explore the opportunities to develop heat distribution networks which will supply heat from the existing incineration plants to domestic, commercial and public buildings in the vicinity.

Also:

'The Mayor is looking for London to double its Combined Heat and Power (CHP) capacity by 2010 and will expect CHP to be included in all new building developments where feasible.' (Note: Current capacity is estimated at 175MWe implying a further 175MWe capacity to be constructed.)

The four key objectives of the Mayor's energy strategy are:

- reducing CO_2 emissions
- eradicating fuel poverty
- developing London's economy
- improving security of energy supply

Community Heating is therefore a key component of the Mayor's Energy Strategy.

The first stage of the study involved collection and collation of available data relating to energy, and particularly heating, demand in London. Questionnaires were sent out to all the London Boroughs and other major energy users who were potential heat customers for the new CH schemes.

In parallel with the work on heat demands, a detailed review of heat generation technologies was carried out. This considered the use of CHP at different scales, biomass fuels, energy from waste, heat from existing power stations, heat pumps or other industrial heat sources. The study evaluated a number of approaches to CH ranging from wide-area heat distribution networks such as that developed in Copenhagen to large numbers of smaller localised energy centres supplying groups of buildings.

An initial list of Priority Areas was drawn up based on economic indicators such as heat density, number of existing CH systems and social indicators such as regeneration areas and the multiple deprivation index. This list of areas was further refined to identify nine specific schemes from which three were selected to be taken forward for more detailed analysis. This work has been reported separately in the Stage 1 Report.

The final part of the study involved detailed work on three selected schemes, which could form the first phase of a London Community Heating strategy.

1.2 Options Appraisals

The options appraisal analysis was carried out in accordance with the Community Energy Programme (CEP) requirements. The economic and environmental feasibility of a CH network utilising CHP (CH/CHP) has been compared with a 'do minimum' option and an 'alternative' option.

The 'do minimum' option was based on retaining and maintaining the existing heating systems with equipment replaced on a like-for-like basis as and when it breaks down.

The 'alternative' option was based on upgrading the existing heating systems with new boilers, except for the Tower Hamlets scheme where small-scale CHP was taken to be the alternative for the housing sector.

For the proposed scheme to be considered for a capital grant from the CEP the net present cost at a 3.5% discount rate over 25 years must be lower than the other options and the scheme must also generate carbon savings.

1.3 Structure of this Summary Report

Section 2 of this report summarises the work carried out in the Stage 1 review.

Section 3 discusses the selection of the three schemes for subsequent analysis.

Sections 4 to 6 describe each of the three schemes.

Sections 7 and 8 detail the economic and environmental benefits that were calculated in the Options Appraisals and Section 9 details the work developing the business plans for each scheme.

Section 10 discusses the work carried out on assessing the energy strategies for new build dwellings and Section 11 considers the feasibility of supplying heat from the existing Barking power station to the Thames Gateway developments north of the Thames.

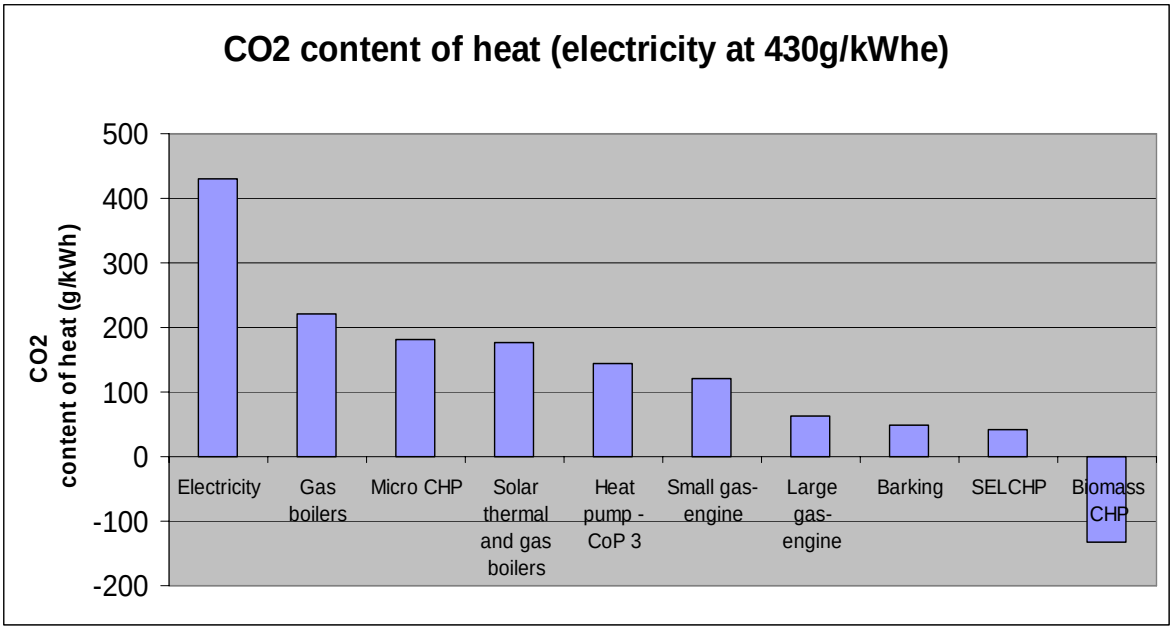
Sections 12 and 13 provide the conclusions and recommendations for the study as a whole.

2. Stage 1 Review

The Stage 1 review commenced by collecting data from Borough Energy Managers and other sources to build up a picture of heat demand in the capital. Use was made of the GIS software Mapinfo in analysing and presenting the data. In addition to the energy consumptions data available from the Boroughs, use was made of the 2001 census data and the previous work carried out by PBPES on behalf of BRESEC and DEFRA on the national potential for CH/CHP.

The second area of work was an assessment of the available low carbon heat sources that might be used to supply CH schemes. The carbon content of the available heat sources was calculated per unit of heat supplied and is given in Figure 2.1 below.

Figure 2.1 – Comparison of CO_2 content in various heat sources



In practice the heat content from a CHP scheme will be higher than shown as some boiler use will be required at peak times and when the CHP plant is being maintained. It can be seen that CHP systems, particularly those involving extraction of heat from existing power stations and where biomass is the fuel will give substantial CO_2 savings over micro-CHP, gas boilers with solar thermal systems and heat pumps.

A review was carried out into technologies for the use of biomass and municipal waste. It was established that the most viable technology at present for biomass was conventional combustion on a suitable grate and raising of steam for a steam turbine CHP system. A possible alternative is the bubbling fluidised bed boiler for the steam raising element. In future, other technologies such as gasification and pyrolysis are contenders for CHP plants with the advantage that these can be developed at a smaller scale, however, the technology is not well proven at present. Various new forms of waste to energy plants are also available, including pyrolysis however the waste disposal companies approached did not have immediate plans to introduce such plants. It was considered unrealistic to base the first new CH schemes on these technologies although in the future their use as a heat source could well be valid. Although these newer waste technologies can be used at a smaller scale than mass incineration plant, such as SELCHP, finding suitable sites within built-up areas will be difficult and hence the use of larger CH networks would still be an advantage if CHP plants based on municipal waste are to be realised.

3. Development of selected schemes

After the data was obtained it was possible to identify Priority Areas using Geographic Information System (GIS) software to analyse and present the data. A total of 32 Priority Areas were defined principally by using the GIS to plot the coincidence of areas with a high social housing density and high levels of deprivation as indicated by the GLA's Multiple Deprivation Index. In addition, location of existing CH estates was considered important to enable the heat load to grow rapidly. Other factors used in identifying the Priority Areas were the zones of new housing proposed within the Thames Gateway and the proximity to existing heat sources.

From the Priority Areas, nine specific schemes were identified which linked adjacent Priority Areas together and from these, three schemes were prioritised which were judged to have the most potential. These were:

- The SELCHP scheme. This has the advantage of making use of an existing low carbon heat source that was sited close to Priority Areas. It also had the merit of being able to be progressively expanded without major investments.

- The Brixton and Camberwell scheme was identified again from the Priority Areas and also the proximity of two hospitals which could be an advantage for sales of electricity as well as heat. In the Lambeth area it was known that not only was there an existing CH estate but also a development project that would employ CH in the future.

- The Tower Hamlets scheme which could supply a number of Priority Areas with high social housing density in a deprived area. Tower Hamlets has a number of existing estates supplied by CH. The redevelopment of the London Hospital represented a major potential customer

Other schemes identified but not taken forward initially were:

- The Thames Gateway area north of the Thames using heat from Barking power station
- Areas in Hackney and Camden
- Areas in Westminster and Kensington and Chelsea

Later in the study a Variation Order was issued which enabled work to be carried out on the first of these schemes.

It was also known that initiatives were already underway in Greenwich (Tilfen Land) and Croydon Town Centre and the study did not wish to overlap with projects that were already in the development stage.

The following sections provide further details of the three schemes analysed in more detail.

4. SELCHP scheme

The SELCHP scheme involves taking heat from the existing waste to energy plant and supplying housing which is already served by community heating in the local area. There is at least 40MW of heat available with a low carbon content. The heat load that can be supplied is located to the north, west and east of the plant. As a result it is possible to phase the development to enable the concept to be established before requiring further capital financing.

Phase 1A has been defined which supplies most of the housing to the north of the plant, the largest estate on this branch, New Place, contains 1,663 dwellings. Adjacent to the plant the Silwood estate is being re-developed and 750 new dwellings are planned. Connecting these to SELCHP would be economic and environmentally beneficial.

To the east there are a number of estates owned by LB Lewisham that although not currently supplied by CH could be converted, in particular four tower blocks which are currently electrically heated. The Pepys estate in Lewisham is being re-developed by Hyde Housing Association and is another potential customer. The most important development however is the Convoys Wharf area which is being developed as a mixed use site with 3,500 dwellings and 109,000m^2 of commercial space. The current energy strategy prepared for this development recognises the potential benefits of taking heat from SELCHP as a way of meeting the requirements of the London Plan.

To the west of the plant there are a number of housing estates owned by LB Southwark which are already supplied by CH. These include Acorn and North Peckham (1,500 dwellings). There is the potential for further expansion to the west to supply the estates examined in the Brixton and Camberwell scheme (see section 5). The main difficulty with this branch is the need to find a route to cross the Old Kent Rd and a tunnel is likely to be needed if major disruption is to be avoided.

Development of this project offers a number of advantages:

- The project aligns with the Mayor's Energy Strategy and Government objectives for increasing CHP capacity and achieving CO_2 savings.
- Heating costs to residents can be reduced as a result of reduced fuel use and lower maintenance costs
- There will be no additional combustion of fuel or waste and the fuel displaced at the local boilers will result in lower local emissions of NOx so air quality will improve
- Security of supply will be improved due to the interconnection of the estates and the multiple heat production sources that become available
- There is the potential for some capital funding being provided by the owners of SELCHP
- Some of the estates to be connected have other funds allocated for upgrading works so the timing of this project is good
- The CHP plant already exists which reduces the development time as there is no need to identify a site and obtain planning permission

It was therefore recommended that the Phase 1A was taken forward into the Business Planning stage as discussed in section 9.

5. Brixton and Camberwell scheme

This scheme was designed to supply a number of housing estates in Lambeth and Southwark with a total number of dwellings of 3,000. the largest estates are Wyndham and Brandon (LB Southwark with 2,200 dwellings). Wyndham already has a 1MWe CHP system which would be retained.

Myatts Fields North in Lambeth is a new-build PFI housing development that could be connected to the scheme. In addition Kings College and the South London and Maudsley hospitals which are on adjacent sites would be included and also Archbishop Ramsay Technical College.

The CHP plant selected was two 5.1MWe spark-ignition gas-engines, which offer high electrical efficiency and hence maximise CO_2 savings.

As an alternative to the gas-engine scheme the feasibility of supplying these buildings from SELCHP by an extension of the western branch was investigated.

6. Tower Hamlets scheme

The London Borough of Tower Hamlets has a number of small CH schemes supplying mainly housing estates. Some of these have been the subject of studies for smaller-scale CHP installations. The study therefore considered the benefits of connecting these estates together to a large CHP plant compared to the use of small-scale CHP at each estate.

The review of the CHP options identified biomass CHP as being able to offer the maximum CO_2 saving. A review of the technologies indicated that large-scale combustion systems with steam turbine generators were the most well established technology. The economics of such a plant are dependent on scale and a size of around 15-30MWe was considered to be feasible. This implies the collection of heat load on a large-scale and the identification of a suitable site for the plant including space for storage of the relatively bulky fuel. It was found that the Tower Hamlets scheme proposed would be suitable for such a heat source given the size of the heat load that could be assembled from existing CH estates and the hospital and that areas of industrial land which were due to be redeveloped were available, whether within the Borough or immediately adjacent in Newham.

7. Economic results

The economics of each scheme have been evaluated by calculating the Net Present Cost for the supply of heat to the buildings for three scenarios:

- A 'Do-minimum' case, where existing equipment is replaced on a like for like basis only when needed
- An 'Alternative' case where new gas-fired boiler equipment is installed with improved efficiency
- A CH-CHP case

The analysis assumes a 3.5% real discount rate and a 25 year period.

In the case of the SELCHP scheme, the minimum Phase 1A scheme is presented as well as the All Phases scheme. In the case of the Tower Hamlets scheme the alternative includes small-scale CHP at each of the housing estates.

The following tables present the NPC results:

Table 7.1 – Economic Comparisons for SELCHP - Phase 1A

Option	Capital	NPC
	£m	£m
Do-minimum	0	13.802
Alternative	2.229	13.580
CH-CHP	5.354	10.218
Net benefit cf Do-minimum		3.584

Table 7.2 – Economic Comparisons for SELCHP - All Phases

Option	Capital	NPC
	£m	£m
Do-minimum	0	71.863
Alternative	8.739	83.730
CH-CHP	26.661	68.178
Net benefit cf Do-minimum		3,686

Table 7.3 – Economic comparisons for Brixton/Camberwell

Option	Capital	NPC
	£m	£m
Do-minimum	0	33.951
Alternative	4.157	32.949
CH/CHP	13.959	31.027
Net benefit cf Do-minimum		2.925

Table 7.4 – Economic comparisons for Tower Hamlets

Option	Capital	NPC
	£m	£m
Do-minimum	0	49.487
Alternative	21.880	39.746
Biomass CH-CHP – Scenario 2	49.669	41.030
Net benefit cf Do-minimum		8.457

In all cases the NPC for the CH-CHP option is less than the Do-minimum so the CHP-CH projects are economic for the given economic criteria of 3.5% discount rate over 25 years. In relation to the NPC, the most economic projects are SELCHP Phase 1A and the Tower Hamlets biomass project.

The small-scale CHP option (the 'Alternative' in Table 7.4) is slightly more economic than the CH-CHP option as it has a NPC 3% lower. The CO_2 benefits however are much higher (see section 8 below).

The Brixton and Camberwell scheme is the most marginal of the schemes analysed. As an alternative, the extension of the SELCHP scheme westwards to supply the housing estates included in the Brixton and Camberwell scheme was analysed. The hospital were excluded as they currently have a steam demand. It was found that this extension had a real rate of return of 13%, which is much higher than the returns from the Brixton/Camberwell project. Hence in the All Phases SELCHP case the housing estates in the Brixton/Camberwell project have been included.

8. Environmental benefits

The principal environmental benefit from CHP is a reduction in CO_2 emissions, the most important greenhouse gas. For the SELCHP scheme there would also be a significant reduction in NOx emissions. The following figures show the CO_2 emissions for the do-minimum (existing), alternative and CH/CHP options for each scheme.

Figure 8.2 - CO_2 emissions for SELCHP – Phase 1A

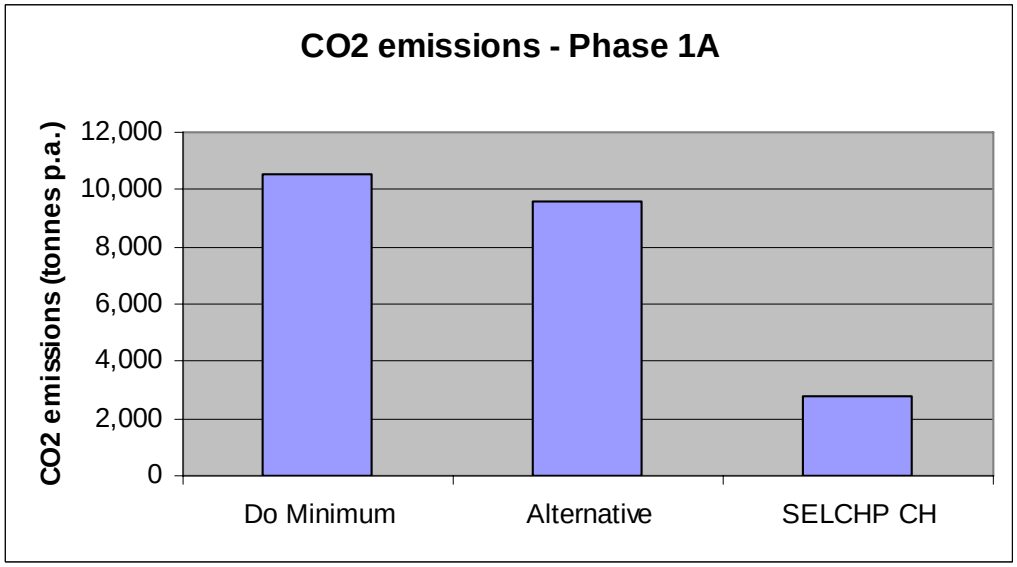


Figure 8.2 - CO_2 emissions for SELCHP - All Phases

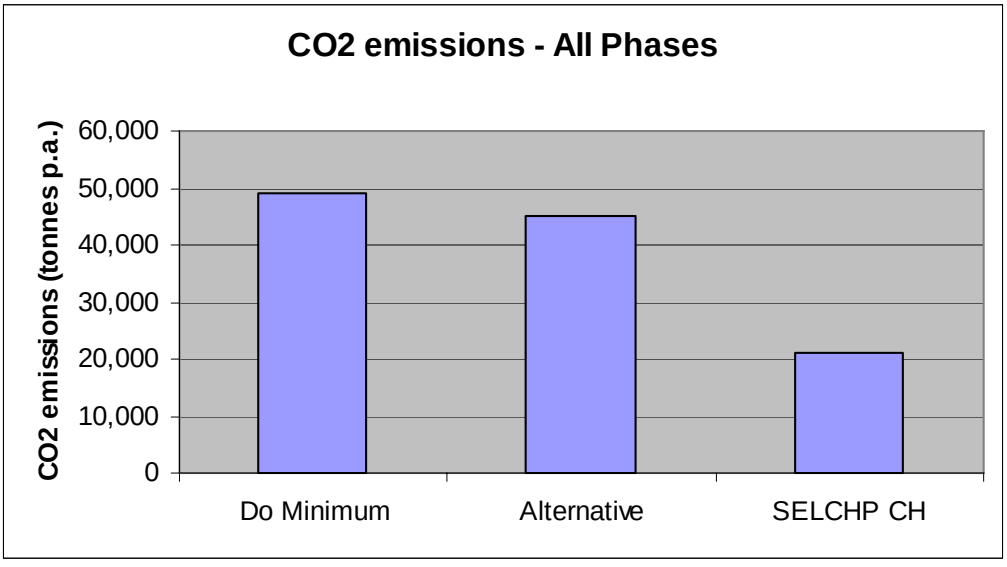


Figure 8.3 - CO_2 emissions for Brixton and Camberwell Scheme

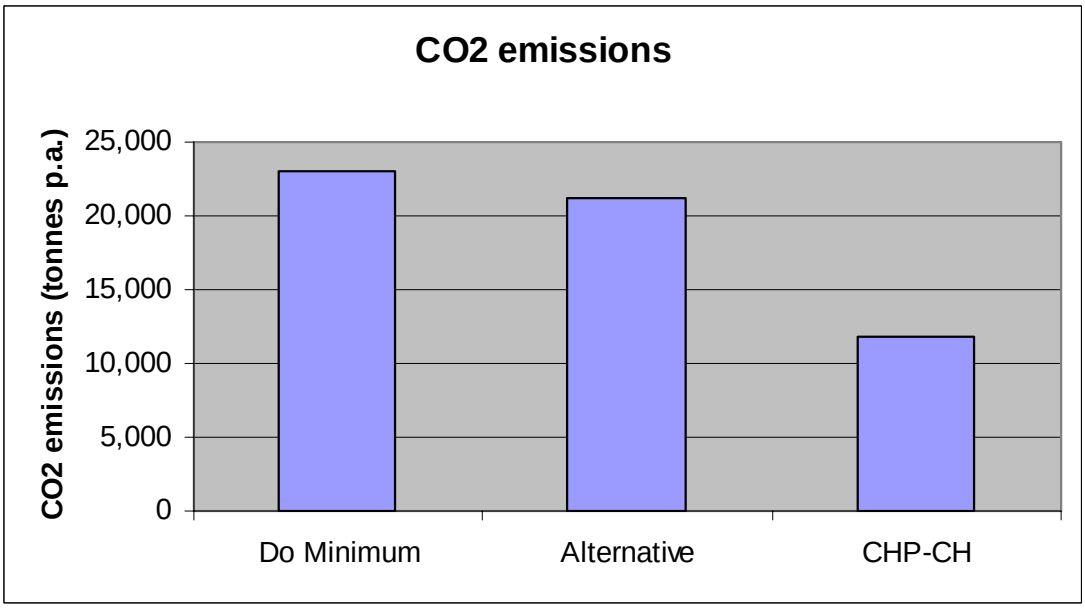


Figure 8.4 - CO_2 emissions for Tower Hamlets Scheme

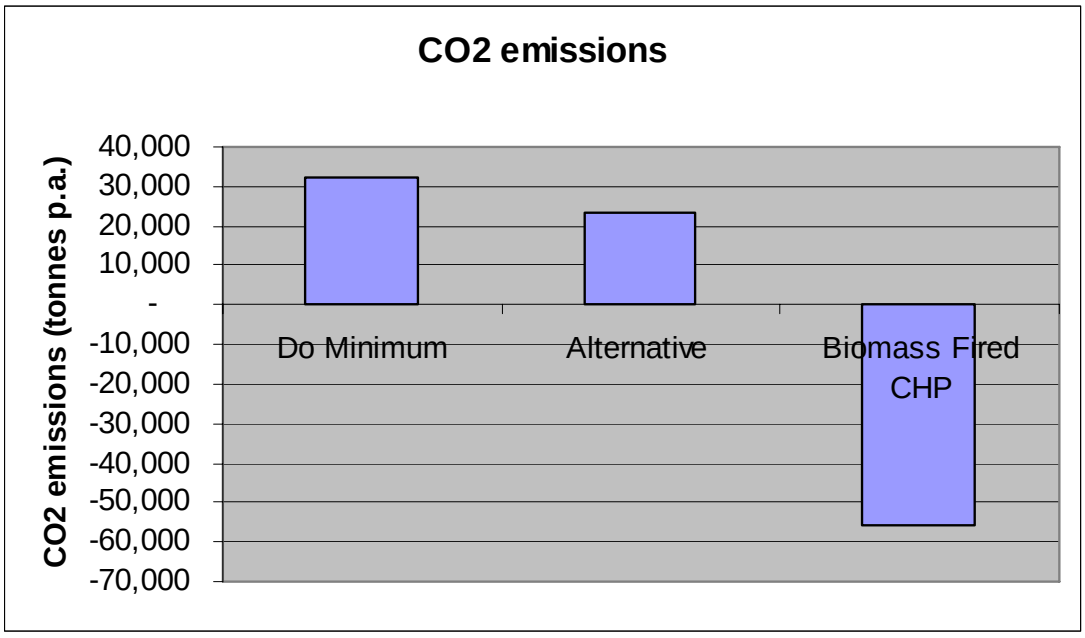
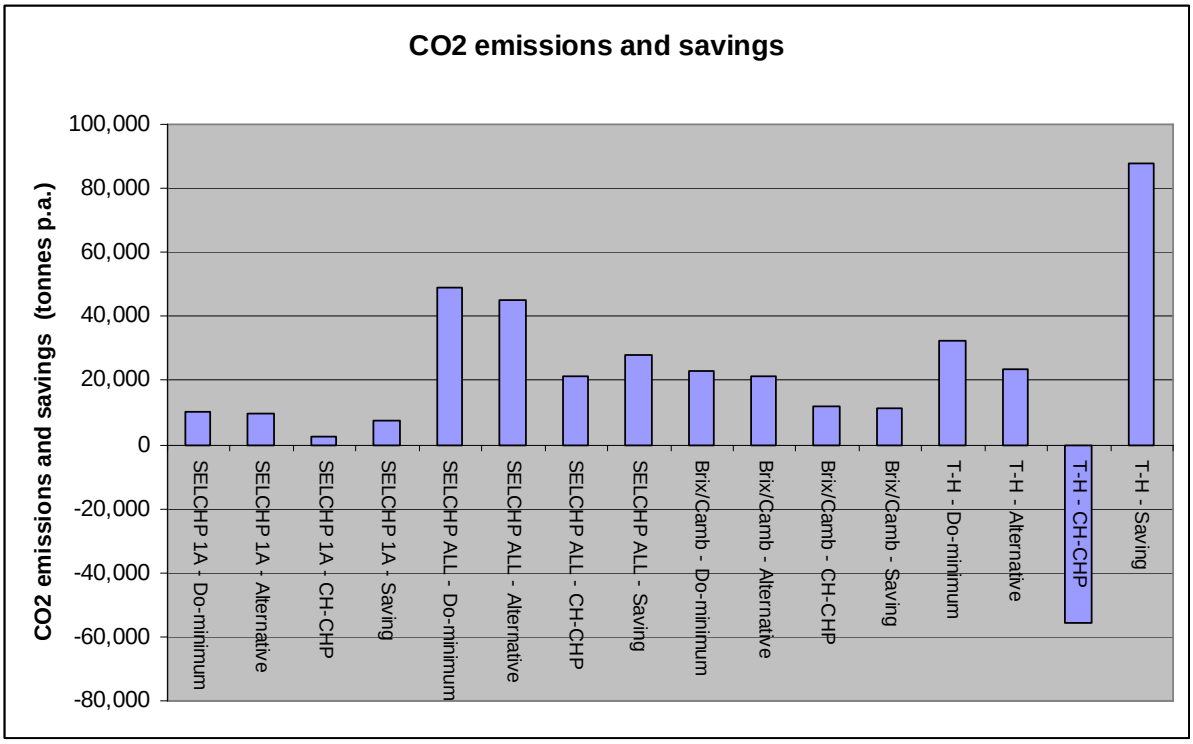


Figure 8.5 – Comparison of CO_2 emissions and savings



9. Social Benefits

The selected schemes have been targeted on areas of high deprivation where fuel poverty may be prevalent. The use of CH supplied by CHP offers the prospect of more stable energy prices and in the longer term significantly lower energy costs when the capital investment of the heat network has been recovered. The GLA's Index of Multiple Deprivation (IMD) has been used as an indicator for fuel poverty and is available for each electoral ward. The Index is on a scale of 1 to 100 with 100 representing an area with highest deprivation. Across London the highest index was found to be 76. An index of more than 40 occurs in the 25% most deprived wards in London, an index over 50 the 14% most deprived and over 60 the 5% most deprived. The proposed heat networks have been analysed to assess the level of deprivation in the areas to be supplied with heat. The results are:

- SELCHP northern branch: average IMD = 41.3
- SELCHP eastern branch: average IMD = 55.0
- SELCHP western branch: average IMD = 56.5
- Tower Hamlets network: average IMD = 57.4

It can be seen that all the schemes are focused in the 25% most deprived wards with the western and eastern branch of SELCHP and the Tower Hamlets scheme providing heat in the 10% most deprived wards in London.

Drawing No: 69242A-M023 rev A illustrates how the proposed network align with areas of deprivation.

10. Business Planning

Following a study of available business structures for this new infrastructure, business plans were drawn up for the three prioritised schemes.

The SELCHP scheme would be developed in Phases with Phase 1A being funded by SELCHP for the work within the SELCHP plant, LB Southwark and a CEP capital grant. It is recommended that an internal management structure be set up within LBS to enable costs to be monitored and company accounts to be prepared so that some form of public-private partnership could be set up at a later date with full knowledge of all of the costs involved.

The business model assumed for the Brixton and Camberwell scheme would be a public-private partnership energy services company, which would be able to raise the necessary capital and operate the scheme.

The Tower Hamlets scheme is assumed to be developed under the Limited Liability Partnership arrangement whereby interested parties agree to participate in a number of ways and share the net income from the project in defined shares. This arrangement is very flexible and it incentivises all parties to maximise the net income from the project, rather than just their own area of interest, to make the scheme a success.

Further business planning work is recommended for the proposed DH transmission pipeline from Barking power station which would have a different capital and risk profile given the scale of the project and because the source of heat is an existing facility.

11. Energy Strategies for LDA Zones

A number of possible energy strategies for the new build developments in the Thames Gateway were defined using a decision tree approach. The CO_2 emissions for each strategy were calculated for a typical two-bedroom flat of 70m^2 floor area in a six-storey block. The results for a selection of these strategies are given in Table 11.1, which compares the annual CO_2 emissions per dwelling to the current practice of using electric heating with the current Building Regulations. It can be seen that CHP from large gas-engines or CCGT compete well with gas boilers and solar thermal systems.

The comparisons have not include a comparative economic calculation as this was outside the scope of this study however further work to carry out such an analysis is recommended.

Table 11.1 – Comparison of energy strategies for a new 2-bedroom flat

Scenario	Type of heat source	Solar thermal	BIPV and BIWT	Total Carbon Dioxide Emissions	CO2 Emission Reduction to ADL2002(A1)
				tCO_2 p.a.	%
A1	Electric (2002 Building Regs)			3,010	0.0%
A2	Electric with MVHR			2,390	20.6%
B2	Gas boilers			1,598	46.9%
B6	Micro-CHP			1,457	51.6%
D1	Small gas-engine CHP			1,429	52.5%
E1	Large gas-engine CHP			1,332	55.7%
B4	Gas boilers	√		1,325	56.0%
F1	CCGT CHP			1,244	58.7%
D2	Small gas-engine CHP		√	1,148	61.9%
B5	Gas boilers	√	√	1,120	62.8%
E2	Large gas-engine CHP		√	1,051	65.1%
G1	Biomass CH			972	67.7%
F2	CCGT CHP		√	963	68.0%
G2	Biomass CH		√	691	77.0%
H1	Biomass CHP			- 266	108.8%
H2	Biomass CHP		√	- 547	118.2%

In addition to the annual energy use and CO_2 emissions, the calculation also estimated the peak gas and electricity demands for each strategy, which will be of value in discussions with the utility companies providing the energy infrastructure to the Thames Gateway.

12. The Barking Power Station Scheme

The original brief for the study was extended in January 2005 to include an evaluation of a CH scheme which would be based on using heat from the existing power station at Barking to supply the new buildings planned for the Thames Gateway area north of the river Thames.

Barking power station is one of the new generation of gas-fired Combined Cycle Gas Turbine (CCGT) and was commissioned in 1992. It has a capacity of 1,000MWe and initial studies indicate that the heat available would be of the order of 250MWth without major changes to the existing equipment. In addition, the current owners are considering increasing the capacity of the plant with a new 400MWe CCGT plant that could be designed to supply a further 250MWth as a CHP plant.

The potential 500MWth CHP supply can be compared with the estimated peak heat demand of all of the new housing planned in the north Thames Gateway area of 153MW. There would be sufficient heat available to supply not only the new buildings but also a substantially larger heat market of the existing buildings as well. The development of a heat supply from Barking power station is thus a strategic opportunity for the whole Thames Gateway area.

The report compared the CO_2 content of heat from Barking with the alternatives of local gas-engine CHP and showed that it would result in greater CO_2 savings. It also results in higher savings that installing solar thermal heating to every property. The carbon content of heat from Barking is calculated at 50.6g/kWh which compares with about 120g/kWh for heat from small-scale CHP systems and 60g/kWh for large-scale CHP systems. In addition, a greater proportion of heat can be supplied from Barking power station than from local CHP as the cost of providing the heat production capacity is much lower than for new CHP plant.

There are several other advantages to this proposal:

- No increase in local NOx production (the emissions from the power station itself would be unchanged as a result of taking heat)
- No need to plan for local CHP Energy Centres and obtain planning permission
- No impact on the local electricity infrastructure
- More flexibility as the load supplied can be gradually increased without a major new investment in heat production capacity
- Makes use of an existing facility and thereby saves on embedded energy and other environmental impacts compared with building new local CHP plant.

A DH transmission main route to supply the Thames Gateway area and through to Tower Hamlets was proposed and surveyed. No major difficulties were found and much of the route is through undeveloped land. The pipeline would cross Barking Creek using the existing road bridge as a support. The use of the Thames Water northern outfall sewer as a route for either buried or above ground pipes was discussed at a meeting with Thames Water and agreement reached in principle.

Preliminary economic calculations were encouraging, particularly if the Levy Exemption Certificate (LEC) benefit was taken into account. It was found that the cost of heat to Tower Hamlets would be higher than from the biomass plant (if the LEC benefit excluded). The results

indicate that the Loads 1- 6 case, which includes the Royal Docks area as well as Barking Town Centre, South Dagenham and Barking Riverside would give the best return, i.e. assuming that the biomass plant to supply Tower Hamlets is also constructed. Hence this project benefits from economies of scale and also the connection of loads that will be built early in the Thames Gateway development programme.

Table 12.1 – Results of Economic Evaluation

	excluding LEC benefit		including LEC benefit	
Case	**IRR (%)**	**NPV (£)**	**IRR (%)**	**NPV (£)**
Loads 1 - 8 including Tower Hamlets	3.5	0	9.59	37,652,862
Loads 1 - 8 excluding Tower Hamlets	2.30	-£6,004,552	6.87	19,670,672
Loads 1 - 6	3.36	-£973,310	7.91	20,313,300
Loads 1 - 4	1.85	-£4,535,001	5.99	7,620,405

The carbon savings that would be associated with the Tower Hamlets load are estimated at 20,013 tonnes CO_2 p.a. This compares with the 87,862 tonnes p.a. saving estimated for the biomass plant. It is clearly beneficial to implement the biomass scheme to obtain maximum CO_2 savings.

13. Conclusions

Each of the four schemes identified use a different CHP technology showing that adopting a single model for CH development is not likely to be an optimum solution for London. Heat from waste to energy plant, gas-engine CHP, new biomass CHP plant or extraction of heat from major power stations are all feasible low carbon heat supply solutions.

All of the schemes identified met the economic criteria of achieving lower energy costs over a 25 year period when compared to the best boiler only alternative scheme or continuing with the present facilities. For Tower Hamlets, the life cycle costs for the large-scale biomass scheme (for the central fuel assumptions) were only slightly higher than that of local gas-engine CHP units and the CO_2 savings were much higher.

The analysis for the new build areas showed that CHP from the existing Barking power station would be preferred over local gas-engine CHP or a gas-fired boiler system with solar thermal panels in terms of CO_2 reductions. The supply of heat from Barking power station was found to be feasible although the supply of the new buildings in the Royal Docks area would need to be considered as well as more local loads. A further extension to the Lower Lea Valley and Tower Hamlets would be feasible but was not found to be able to compete with the biomass plant proposed for Tower Hamlets. The economics of this scheme would be improved by including existing buildings and further study of this option is recommended.

14. Recommendations

14.1 Critical issues for implementation

The study has identified four leading opportunities for Community Heating in London:

- a CH network based in Southwark, Lambeth and Lewisham supplied by the SELCHP plant, with an initial Phase 1A supplying LB Southwark property only
- a CH network in Lambeth and the western part of Southwark that could also be economically supplied by SELCHP
- a CH network that supplies existing CH estates and other major buildings in Tower Hamlets supplied by a new biomass CHP plant
- a CH network in Zones 4 and 5 of the Thames Gateway area (north of the Thames) supplied by the existing Barking CCGT power station.

For these projects to be developed, three issues are critical:

- commitment of the customers for heat
- feasibility and costs of the provision of heat from the heat sources identified
- feasibility and costs of the CH network
- a suitable business structure to implement the project

Each proposed scheme is discussed in turn using these headings to determine the way forward and identify recommendations:

14.2 SELCHP – Phase 1A

Customer commitment

LB Southwark needs to make a commitment to support the scheme and buy heat from the new heat source. The advantages are: lower CO_2 emissions, lower costs and improved security of supply.

Recommendation 1 – paper to be presented to LBS Council for decision in principle.

Heat source

SELCHP will need to confirm that they are willing to supply heat and that the costs put forward in this report for the works needed within SELCHP are appropriate.

Recommendation 2 – SELCHP to carry out independent study.

Heat mains

The heat mains for Phase 1A appear to be feasible but further work to design and obtain more detailed cost estimates is recommended. Also a more detailed study of the conversion of the New Place system to operate at lower temperature is required.

Recommendation 3 – further technical studies are commissioned by LB Southwark to enable more accurate cost estimates to be obtained for use in the application for a grant from the Community Energy Programme

Business structure

The most suitable business structure for Phase 1A is for the funding of the works within SELCHP to be by SELCHP and the funding of the heat mains to be by LB Southwark capital resources. LB Southwark should set up an internal management structure for the project construction and operation to enable costs to be clearly separated so that a partnership with the private sector can be established in the future. An application to the Community Energy Programme (CEP) for a possible October 2005 round should be pursued.

Recommendation 4 – SELCHP to confirm willingness to fund works within their site

Recommendation 5 – LBS to allocate budget for the heat network and conversion work
Recommendation 6 – LBS to apply to the CEP for a capital grant (provisional deadline October 31st 2005)

Recommendation 7 – LBS to set up a suitable internal structure to enable costs for this project to be separately identified during development, construction and operation

14.3 Tower Hamlets

Customer commitment

Commitment to support the scheme in principle is required from the Housing Associations responsible for the estates identified, LB Tower Hamlets for the other buildings such as schools and leisure centres, and the Royal London Hospital Trust and their PFI contractor for the redevelopment of the Royal London hospital (Whitechapel).

Recommendation 8 – paper to be presented to HA's for decision in principle.

Recommendation 9 – paper to be presented to LBTH Council for decision in principle.

Recommendation 10 – paper to be presented to Hospital and PFI Contractor for decision in principle.

Heat source

Further development work on the biomass plant is required before the scheme can be taken further, in particular to obtain planning permission, and to obtain more certainty on fuel availability and costs. Details of how the fuel will be delivered to the site will be a critical issue. The viability will also be influenced by the value placed on electricity produced by the plant and further work in this area would be useful.

Recommendation 11 – carry out further design work and consultations with the site owner and then submit a planning application to LB Newham.

Recommendation 12 – carry out a more detailed study of the availability of clean waste wood resource in London and biomass woodchips in the south-eat of England to confirm expected costs

Recommendation 13 – investigate further the range of electricity prices that could be obtained in the market for electricity produced by the plant.

Heat mains

The heat mains routes identified appear to be feasible but further work to design and obtain more detailed cost estimates is recommended. Also a more detailed study of the potential to supply adjacent areas of new build in the Lower Lea Valley and Canning Town is needed. This could influence the size of the plant.

Recommendation 14 – further technical studies of the heat mains routes are commissioned to enable more accurate cost estimates to be obtained.

Recommendation 15 – discussions with LDA, LB Newham and developers in the Lower Lea Valley/Canning Town area are held to determine potential for expansion of the network.

Business structure

The preferred business structure for this scheme is the Limited Liability Partnership. Further discussions with the various potential partners should be initiated to establish the desirability of this arrangement. This would lead to the preparation of an invitation document to join the partnership which would develop the project.

Recommendation 16 – initiate discussions with relevant parties on the LLP concept

Recommendation 17 – prepare an invitation document for selection of partners

14.4 Zones 4 and 5 - Thames Gateway

Customer commitment

Although there are estimates available of the numbers of new dwellings to be built have been made by the LDA, more work needs to be carried out to confirm these numbers and to identify non-domestic buildings that could be connected. In addition, the study only considered the supply of heat to new buildings in the LDA area as well as a supply to Tower Hamlets. The inclusion of existing buildings in the Barking and Royal Docks areas is likely to significantly improve the volume of heat sales and the economics. The commitment of customers will be obtained only when firmer indications of cost are available not just for the CH supply but also for the other options of local gas-engine CHP, solar thermal and other renewable energy sources. This study needs to take account of the costs that might be imposed on the LDA by utility companies for each strategy. When the costs are established then commitment from all developers in the area will be needed if the CH supply from Barking power station is to be pursued. Following this commitment, discussions can be held with the utility companies to confirm requirements for new infrastructure in the area.

Recommendation 18 – commission a study to establish a more accurate prediction of heat demand for both new and existing buildings in the area
Recommendation 19 – LDA to commission a study to compare the costs of meeting or exceeding the new Building Regulations and the London Plan requirements and hence determine a recommended energy strategy that may or may not be based on CH and taking heat from Barking power station. The study to take account of infrastructure costs from the utilities.

Recommendation 20 – Dependent on the outcome of the more detailed studies, the LDA should establish the energy strategy for the area and obtain commitment of developers to the strategy

Recommendation 21 – discuss with utility companies the requirements for new infrastructure in the area.

Heat source

The owners of Barking Power Station will need to confirm that they are willing to supply heat and that the costs put forward in this report for the works needed within the power station are appropriate. The owners are considering a future expansion at the site which could offer lower costs. The position on exemptions from the Climate Change Levy also need to be clarified.

Recommendation 22 – Formally ask Barking Power Station to confirm willingness to supply heat and under what commercial terms.

Heat mains

The heat main route has been surveyed however no discussions have been held with utilities and the local authorities involved. Road, river and rail crossings also need to be discussed with the relevant bodies.

Recommendation 23 – further technical studies are commissioned on the heat mains route and discussions held with the local authorities, utility companies, highways, river and rail authorities.

Business structure

The most suitable business structure for this scheme has not been determined. Should the previous recommendations result in a positive decision to develop a large-scale CH network in the area then the business structures will need to be studied. The issues will be more complex than for the other schemes as commitment in advance from all potential future heat customers will not be available.

Recommendation 24 – commission a study into business structures for the CH network in the LDA area.

14.5 General Recommendations

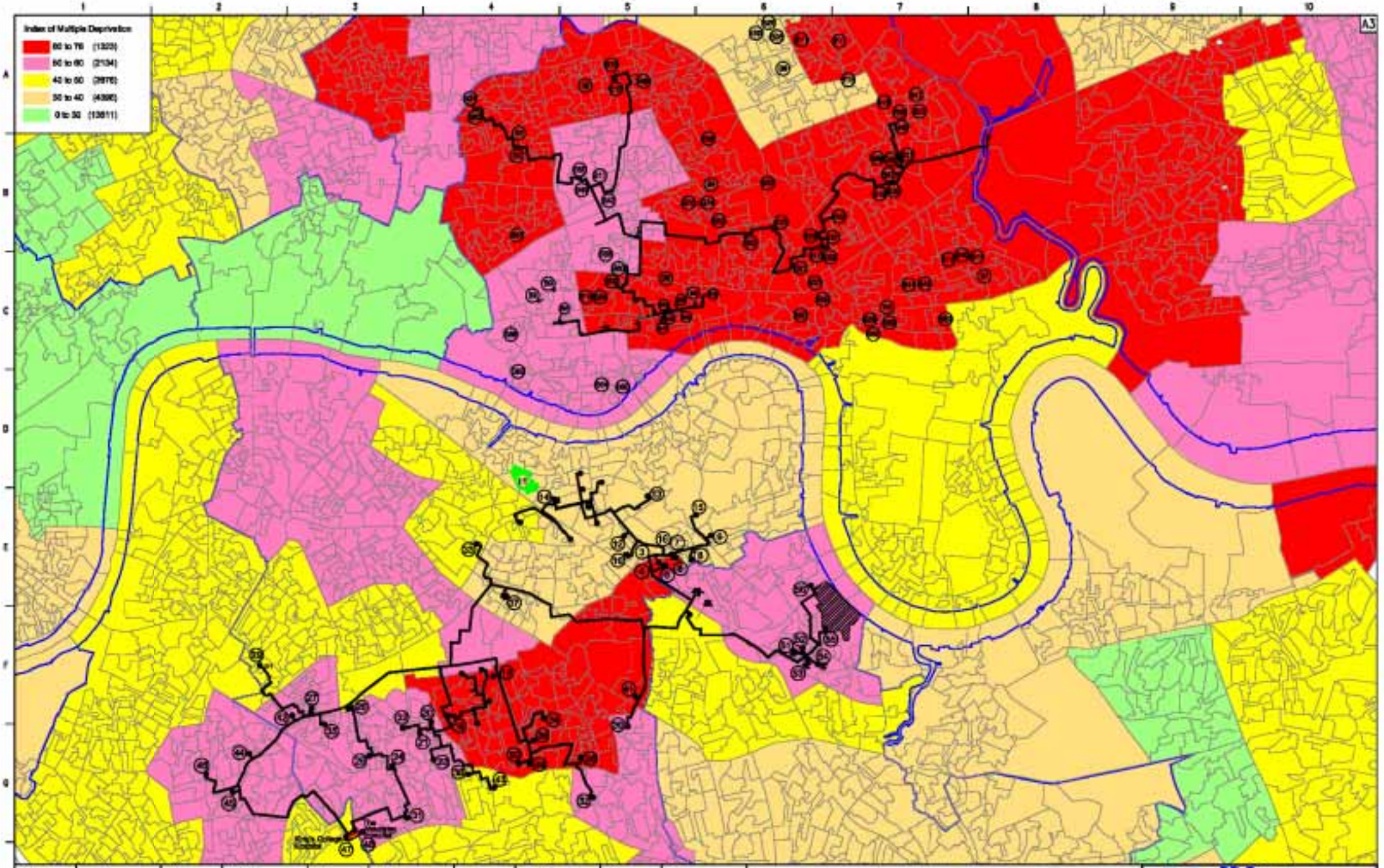
As the scheme proposed for Brixton and Camberwell is less economic than extending the SELCHP scheme it is recommended that efforts are principally directed towards setting up the

SELCHP heat supply however the hospitals should be encouraged to consider CHP for their sites as the heating infrastructure is re-developed.

The Myatt's Field North development in Lambeth should continue to plan for a CH supply and consider making space for a CHP unit on their site but delay a decision on installation until the timing on the construction of the western branch of the SELCHP scheme has been determined.

It will be important to preserve existing CH schemes within all of the Priority Areas by continuing to invest in repairs and upgrading such that a later connection to a wider CH scheme supplied by CHP can be realised without undue cost.

The London Energy Partnership should consider setting up a London CH Partnership to bring together interested Local Authorities, other housing providers, developers and suppliers of design services or equipment. One of the tasks of this CH Partnership could be to set design standards that would enable heating systems to be designed or upgraded to be suitable for a connection to a wider area CH network.



REV.	A	DETAILS	REV.	DETAILS	REV.	DETAILS	REV.	DETAILS	REV.	DETAILS
Drawn:	RK	ISSUED WITH REPORT	Drawn:		Drawn:		Drawn:		Drawn:	
Checked:	AJ		Checked:		Checked:		Checked:		Checked:	
Approved:	PSW		Approved:		Approved:		Approved:		Approved:	
Date:	7/04/08		Date:		Date:		Date:		Date:	

GLA COMMUNITY HEATING POTENTIAL STUDY

AREAS OF DEPRIVATION MAP WITH COMMUNAL HEATING NETWORK OVERLAID

PB Power

Drawn:	RAW
Checked:	AJ
Approved:	PSW
Date:	7/4/08

Scale: -

Drawing No: 69242A-M023

Rev: A

CAD FILE REF: -

Other formats and languages

For a large print, Braille, disc, sign language video or audio-tape version of this document, please contact us at the address below:

Public Liaison Unit
Greater London Authority
City Hall
The Queen's Walk
London SE1 2AA

Telephone **020 7983 4100**
Minicom **020 7983 4458**
www.london.gov.uk

You will need to supply your name, your postal address and state the format and title of the publication you require.

If you would like a copy of this document in your language, please phone the number or contact us at the address above.

Chinese

如果需要您母語版本的此文件，
請致電以下號碼或與下列地址聯絡

Hindi

यदि आप इस दस्तावेज की प्रति अपनी
भाषा में चाहते हैं, तो कृपया निम्नलिखित
नंबर पर फोन करें अथवा नीचे दिये गये
पते पर संपर्क करें

Vietnamese

Nếu bạn muốn có văn bản tài liệu
này bằng ngôn ngữ của mình, hãy
liên hệ theo số điện thoại hoặc địa
chỉ dưới đây.

Bengali

আপনি যদি আপনার ভাষায় এই দলিলের প্রতিলিপি
(কপি) চান, তা হলে নীচের ফোন নম্বরে
বা ঠিকানায় অনুগ্রহ করে যোগাযোগ করুন।

Greek

Αν θέλετε να αποκτήσετε αντίγραφο του παρόντος
εγγράφου στη δική σας γλώσσα, παρακαλείστε να
επικοινωνήσετε τηλεφωνικά στον αριθμό αυτό ή ταχυ-
δρομικά στην παρακάτω διεύθυνση.

Urdu

اگر آپ اِس دستاویز کی نقل اپنی زبان میں
چاھتے ھیں، تو براہ کرم نیچے دئے گئے نمبر
پر فون کریں یا دیئے گئے پتے پر رابطہ کریں

Turkish

Bu belgenin kendi dilinizde
hazırlanmış bir nüshasını
edinmek için, lütfen aşağıdaki
telefon numarasını arayınız
veya adrese başvurunuz.

Arabic

إذا أردت نسخة من هذه الوثيقة بلغتك، يرجى
الاتصال برقم الهاتف أو مراسلة العنوان
أدناه

Punjabi

ਜੇ ਤੁਹਾਨੂੰ ਇਸ ਦਸਤਾਵੇਜ਼ ਦੀ ਕਾਪੀ ਤੁਹਾਡੀ ਆਪਣੀ ਭਾਸ਼ਾ
ਵਿਚ ਚਾਹੀਦੀ ਹੈ, ਤਾਂ ਹੇਠ ਲਿਖੇ ਨੰਬਰ 'ਤੇ ਫ਼ੋਨ ਕਰੋ ਜਾਂ ਹੇਠ
ਲਿਖੇ ਪਤੇ 'ਤੇ ਰਾਬਤਾ ਕਰੋ:

Gujarati

જો તમને આ દસ્તાવેજની નકલ તમારી ભાષામાં
જોઇતી હોય તો, કૃપા કરી આપેલ નંબર ઉપર
ફોન કરો અથવા નીચેના સરનામે સંપર્ક સાધો.

GREATER**LONDON**AUTHORITY

City Hall
The Queen's Walk
London SE1 2AA

www.london.gov.uk
Enquiries **020 7983 4100**
Minicom **020 7983 4458**

MoL/CS D&P/0306